8 AIR QUALITY

8.1 INTRODUCTION

8.1.1 This Air Quality ES Supplementary Environmental Information chapter provides an update of the Air Quality ES 2016 Chapter. Since the original ES was written, there have been a number of changes to technical data and tools:

- Revised traffic data;
- Revised Emissions Inventory published by Defra (version 8, November 2017);
- Revised nitrogen oxides (NO_x) to nitrogen dioxide (NO_2) Calculator (version 6.1, October 2017);
- Revised Background Concentration data published by Defra (Background Maps 2015, November 2017).

8.1.2 Given the relevance of the changes, this ES Addendum chapter replaces the air quality chapter provided in the original ES. A replacement set of air quality appendices have also been provided as many of the appendices provided with the original ES have been updated.

8.1.3 This chapter, updates the existing air quality within the study area, considers the suitability of the site for the Application, and assesses the impact of the construction and operation of the site on air quality in the surrounding area. The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), and for road traffic are NO_2, PM_{10} and $PM_{2.5}$.

8.1.4 The Upper Heyford Sewerage Treatment Works (STW) is located approximately 900 m south-east of the Application Site. The STW is located further away from the Application Site than existing residential properties at Duvall Park on Camp Road. The closest of these properties is located approximately 35 m north-east of the STW boundary. The STW is relatively small and, given the separation distance to the Application Site and the location of existing residential properties, is unlikely to have a significant effect on the Application Site. The effects of odour on residential amenity have not been discussed further in this chapter.

8.1.5 The assessment has been prepared taking into account relevant local and national guidance and regulations.

8.2 LEGISLATIVE AND PLANNING POLICY CONTEXT

National Legislation

8.2.1 The Air Quality Strategy (2007)[1] establishes the policy framework for ambient air quality management and assessment in the UK. The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.

8.2.2 Part IV of the Environment Act 1995[2] introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review

[1] Department of the Environment, Transport and the Regions (DETR, 2007) in Partnership with the Welsh Office, Scottish Office and Department of the Environment for Northern Ireland (2007). The Air Quality Strategy for England, Scotland, Wales, Northern Ireland, HMSO, London
[2] Environmental Act 1995, Part IV.

and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air Quality (England) Regulations 2000[3] and the Air Quality (Amendment) (England) Regulations 2002[4].

8.2.3 Where an objective is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA.

8.2.4 The Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16))[5] issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

<u>EU Limit Values</u>

8.2.5 The Air Quality Standards Regulations 2010[6] implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for nitrogen dioxide (NO_2). These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO_2 EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

8.2.6 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

8.2.7 Despite many areas of the UK not being compliant with the annual average NO_2 limit value, the UK has decided not to seek an extension to the compliance date for this pollutant. This was on the basis that it could not be guaranteed that the UK would be compliant by the latest date allowable under the Directive (1 January 2015).

8.2.8 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

<u>Habitats</u>

8.2.9 European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) requires member states to introduce a

[3] Statutory Instrument 2000, No 921, 'The Air Quality (England) Regulations 2000' HMSO, London.
[4] Statutory Instrument 2002, No 3034, 'The Air Quality (England) (Amendment) Regulations 2002' HMSO, London.
[5] Department of the Environment, Food and Rural Affairs (Defra) in partnership with the Scottish Executive, The National Assembly for Wales and the Department of the Environment for Northern Ireland (2016). 'Local Air Quality Management Technical Guidance, LAQM.TG(16)'. HMSO, London.
[6] Statutory Instrument 2010, No. 1001, The Air Quality Standards Regulations 2010, HMSO, London

range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations (2010)[7] transposes the Directive into law in England and Wales. The Regulations require the Secretary of State to provide the European Commission with a list of Sites which are important for the habitats or species listed in the Directive. The Commission then designates worthy Sites as Special Areas of Conservation (SACs). The Regulations also require the compilation and maintenance of a register of European Sites, to include SACs and Special Protection Areas (SPAs); with these classified under the Council Directive 2009/147/EC on the Conservation of Wild Birds. These Sites form a network termed "Natura 2000."

8.2.10 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

8.2.11 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to a significant effect on the European Site. Where this is the case, it has to carry out an 'appropriate assessment' in order to determine whether the development will adversely affect the integrity of the Site.

8.2.12 Sites of national nature and geological conservation importance may be designated as Sites of Special Scientific Interest (SSSIs), and so have been re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way (CROW) Act 2000. If a development is "likely to damage" a SSSI, the CROW Act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW Act also provides protection to local nature conservation Sites, which can be particularly important in providing 'stepping stones' or 'buffers' to SSSIs and European Sites. In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

Air Quality Objectives and Limit Values

Human Health

8.2.13 The NAQOs for NO_2 and particulate matter (PM_{10}) set out in the Air Quality Regulations (England) 2000[8] and the Air Quality (England) (Amendment) Regulations 2002[9], are shown in **Table 8.1**.

Table 8.1: Nitrogen Dioxide and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen dioxide (NO_2)	1-hour mean	200 µg/m^3 not to be exceeded more than 8 times a year
	Annual mean	40 µg/m^3
Particulate Matter (PM_{10})	24-hour mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40 µg/m^3

[7] Statutory Instrument 2010, No. 490, 'The Conservation of Habitats and Species Regulations 2010' HMSO, London.
[8] Statutory Instrument 2000, No 921, The Air Quality (England) Regulations 2000, HMSO, London
[9] Statutory Instrument 2002, No 3034, The Air Quality (England) (Amendment) Regulations 2002, HMSO, London

8.2.14 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004, respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Analysis of long term monitoring data suggests that if the annual mean nitrogen dioxide concentration is less than 60µg/m^3 then the one-hour mean nitrogen dioxide objective is unlikely to be exceeded where road transport is the main source of pollution. This concentration has been used to screen whether the one-hour mean objective is likely to be achieved[10].

8.2.15 The ambient air quality and cleaner air for Europe directive (2008/50/EC) was adopted in May 2008, and includes a national exposure reduction target, a target value and a limit value for $PM_{2.5}$, shown in **Table 8.2**. The UK Government transposed this new directive into national legislation in June 2010.

Table 8.2: $PM_{2.5}$ Objectives

	Time Period	Objective / Obligation	To be Achieved by
UK Objectives	Annual mean	25 µg/m^3	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background sites	Between 2010 and 2020
European obligations	Annual mean	Target value of 25 µg/m^3	2010
	Annual mean	Limit value of 25 µg/m^3	2015
	Annual mean	Stage 2 indicative Limit value of 20µg/m^3	2020
	3 year Average Exposure Indicator (AEI) [(a)]	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20 µg/m^3	2015

[(a)] The 3 year annual mean or AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

8.2.16 The Air Quality Strategy 2007[11] includes an exposure reduction target for smaller particles known as $PM_{2.5}$. These are an annual mean target of 25 µg/m^3 by 2020 and an average urban background exposure reduction target of 15% between 2010 and 2020.

Ecological Criteria

8.2.17 Objectives for the protection of vegetation and ecosystems have been set by the UK Government and were to have been achieved by 2000. They are summarised in **Table 8.3** and are the same as the EU limit values. The objectives only strictly apply a) more than 20km from an agglomeration (about 250,000 people), and b) more than 5km from Part A industrial sources, motorways and built up areas of more than 5,000 people. However, Natural England has adopted a more precautionary approach and applies the objective to all internationally designated conservation sites and SSSIs. For the

[10] Defra, 2016. Local Air Quality Management Technical Guidance LAQM.TG(16).
[11] Department of the Environment, Transport and the Regions (DETR, 2007) in Partnership with the Welsh Office, Scottish Office and Department of the Environment for Northern Ireland (2007). The Air Quality Strategy for England, Scotland, Wales, Northern Ireland, HMSO, London

assessment of road schemes, Highways England[12] follows this approach and requires an assessment of the impacts of roads traffic emissions on conservation sites (Designated Sites) within 200 m of a road. When pollutant concentrations exceed a critical level it is considered that there is a risk of harmful effects.

Table 8.3: Vegetation and Ecosystem Objectives (Critical Levels)

Pollutant	Time Period	Objective
Nitrogen Oxides (expressed as NO_2)	Annual Mean	30 µg/m^3

8.2.18 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by United Nations Economic Commission for Europe (UNECE). They are defined as the amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Exceedance of a critical load is used as an indication of the potential for harmful effects to occur.

8.2.19 Statutory designated ecological sites (SACs, SPAs, SSSIs and RAMSAR sites) have been included in this assessment where they are within 200 m of a road that has an increase in traffic of more than 1000 AADT resulting from the Development. This is in line with the Highway's Agency Design Manual for Roads and Bridges (DMRB)[13]. Following this criteria, the Ardley Cutting and Quarry SSSI has been identified as a site where assessment of impacts on ecological receptors is deemed necessary. The Ardley Cutting and Quarry and Ardley Trackways SSSIs are the nearest statutory designated sites to the Application Site, approximately 3.5 km north east from the Site boundary. The SSSIs borders the B430 Station Road to the east and west.

8.2.20 **Table 8.4** below shows the habitats most likely to be affected by road traffic emissions from Station Road in the Ardley Cutting and Quarry SSSI and describes the critical loads for each habitat.

Table 8.4: Deposition and Site Relevant Critical Loads

Habitat	Critical Load	
	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Calcareous grassland (Bromus erectus-Brach podium pinnatum lowland calcareous grassland)	15 - 25	0.856 – 4.856
Calcareous grassland (Bromus erectus-lowland calcareous grassland)	15 - 25	0.856 – 4.856
Hamearis Lucina – Duke of Burgundy[a]	-	-
Invertebrate assemblage – Invertebrate Assemblage[b]	-	-

[a] No critical load for nitrogen deposition or acid deposition has been assigned for this

[12] The Highways Agency (2007). 'Design Manual for Roads and Bridges, Volume 11, Section 3, Part I, HA 207/07 Air Quality'. Available at: http://www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20707.pdf
[13] The Highways Agency (2007). 'Design Manual for Roads and Bridges, Volume 11, Section 3, Part I, HA 207/07 Air Quality'. Available at: http://www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20707.pdf

habitat. Information retrieved from the Air Pollution Information System (APIS) website (2016).

[b] The habitat is sensitive to nitrogen deposition and acid deposition, however there is no comparable habitat with established critical load estimate available or acid class.

National Planning Policy and Guidance

8.2.21 The National Planning Policy Framework was published in March 2012. This sets out the Government's planning policies for England and how they are expected to be applied. In relation to conserving and enhancing the natural environment, paragraph 109 states that:

> **"The planning system should contribute to and enhance the natural and local environment by… preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability."**

8.2.22 Paragraph 124, also states that:

> **"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."**

8.2.23 Paragraph 203 goes on to say:

> **"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."**

8.2.24 New National Planning Practice Guidance (NPPG) was published and updated in March 2014 to support the NPPF. Paragraph 001, Reference 32-001-20, of the NPPG provides a summary as to why air quality is a consideration for planning:

> **"… Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit… The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date… If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan… Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive… Odour and dust can also be a planning concern, for example, because of the effect on local amenity."**

8.2.25 Paragraph 002, Reference 32-002-20140306, of the NPPG concerns the role of Local Plans with regard to air quality:

> **"… Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider:**
>
> - **The potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;**
> - **The impact of point sources of air pollution…; and**
> - **Ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."**

8.2.26 Paragraph 005, Reference 32-005-20140306, of the NPPG identifies when air quality could be relevant for a planning decision:

> **"… When deciding whether air quality is relevant to a planning application, considerations could include whether the development would:**
>
> - **Significantly affect traffic in the immediate vicinity of the proposed Application Site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.**
> - **Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.**
> - **Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.**
> - **Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.**
> - **Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly**

> **connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."**

8.2.27 Paragraph 007, Reference 32-007-20140306, of the NPPG provides guidance on how detailed an assessment needs to be:

> **"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific."**

8.2.28 Paragraph 008, Reference 32-008-20140306, of the NPPG provides guidance on how an impact on air quality can be mitigated:

> **"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact… Examples of mitigation include:**
>
> - **The design and layout of development to increase separation distances from sources of air pollution;**
> - **Using green infrastructure, in particular trees, to absorb dust and other pollutants;**
> - **Means of ventilation;**
> - **Promoting infrastructure to promote modes of transport with low impact on air quality;**
> - **Controlling dust and emissions from construction, operation and demolition; and**
> - **Contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."**

8.2.29 Paragraph 009, Reference 32-009-20140306, of the NPPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment:

> **"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:**
>
> **"Consider how proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."**

Local Planning Policy

8.2.30 The Cherwell Local Plan (2011 – 2031)[14], adopted in 2016, sets out the local development policies for the Council. It considers Policy ESD 10 'Protection and Enhancement of Biodiversity and the Natural Environment', which states:

> **"Development which would result in damage to or loss of a site of biodiversity or geological value of national importance will not be permitted unless the benefits of the development clearly outweigh the harm it would cause to the site and the wider national network of SSSI's, and the loss can be mitigated to achieve a net gain in biodiversity/geodiversity… Air quality assessments will also be required for development proposals that would be likely to have a significantly adverse impact on biodiversity by generating an increase in air pollution"**

8.2.31 The Cherwell District Council (CDC) Draft Planning Obligations Supplementary Planning Document (SPD)[15] provides guidance on the level of contribution which will be required in order to compensate for loss or damage created by a development, or to mitigate a development's impact. It sets out the range of mitigation measures which may be required, as well as the means of calculating financial contributions towards measures or monitoring, based on the cost of Air Quality Action Plan measures.

8.2.32 The Council has declared four Air Quality Management Area (AQMAs) and has prepared an Air Quality Action Plan for these existing AQMAs [16]. None of the AQMAs are in close proximity to the Application Site.

8.3 ASSESSMENT METHODOLOGY

Study Area

Construction

8.3.1 The Construction Study Area extends to 350 m from the Application Site boundary, shown in **Figure 8.1**.

Operation

Residential Receptor Locations

8.3.2 The assessment covers the air quality impacts at existing properties along the road links provided in **Appendix 8.2** that may experience an increase in road traffic as a result of the development.

8.3.3 The Operational Study Area extends to where there are significant changes in traffic (more than 500 vehicle movements per day outside of an AQMA, and more than 100 vehicle movements per day within an AQMA). The roads modelled in this assessment are shown in **Figure 8.1**.

[14] Available at: http://www.cherwell.gov.uk/index.cfm?articleid=11344

[15] Cherwell District Council (2011) 'Planning Obligations Draft Supplementary Planning Document'. Available at: https://www.cherwell.gov.uk/downloads/download/458/planning-obligationsdeveloper-contributions-in-preparation

[16] Cherwell District Council (2017) 'Air Quality Action Plan'. Available at: https://www.cherwell.gov.uk/info/69/pollution/463/air-quality/1

8.3.4 Within the study area, relevant sensitive locations have been identified. These locations are described in **Table 8.8**, and shown in **Figure 8.2**. The method used to identify these locations is described in **Paragraph 8.3.22**.

Ecological Receptor Locations

8.3.5 The Ardley Cutting and Quarry SSSI has been included in this assessment in accordance with the DMRB guidance criteria[13]. The SSSI is within 200 m of Station Road which has an increase in traffic of more than 1,000 AADT (Annual Average Daily Traffic) resulting from the Application. Therefore, the Ardley Cutting and Quarry SSSI has been identified as a site where assessment of impacts on ecological receptors is deemed necessary.

Surveys

Baseline Data Collection

8.3.6 Information on existing air quality has been obtained by collating the results of monitoring carried out by CDC. Background concentrations for the study area have been defined using the national pollution maps published by Defra; these cover the whole country on a 1x1 km grid[17].

8.3.7 Existing nitrogen and acid deposition rates for habitats within the study area were determined from the APIS website[18].

Significance Criteria and Methodology

Construction

8.3.8 During construction the main potential effects are dust annoyance and locally elevated concentrations of PM_{10}. The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.

8.3.9 Separation distance is also an important factor. Large dust particles (greater than 30μm), responsible for most dust annoyance, will largely deposit within 100 m of sources. Intermediate particles (10-30 μm) can travel 200-500 m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10 μm) are deposited slowly and may travel up to 1km; however, the impact on the short-term concentrations of PM_{10} occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

8.3.10 The Institute of Air Quality Management (IAQM)[19] has issued revised guidance on the assessment of dust from demolition and construction. The IAQM guidance recommends that the risk of dust generation is combined with the sensitivity of the area surrounding the site to determine the risk of dust impacts from construction and demolition activities.

[17] Department of the Environment, Food and Rural Affairs (Defra) (2017). 2015 Based Background Maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$. Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015

[18] Air Pollution Information System (APIS) (2017). Available at: http://www.apis.ac.uk/

[19] Institute of Air Quality Management (2014) Assessment of Dust from Demolition and Construction, IAQM, London

Depending on the level of risk (high, medium, low or negligible) for each activity, appropriate mitigation is selected.

8.3.11 In accordance with the IAQM 2014 guidance, the dust emission magnitude is defined as large, medium or small (**Table 8.5**) taking into account the general activity descriptors on site and professional judgement.

8.3.12 The sensitivity of the study area to construction dust impacts is defined based on the examples provided within the IAQM 2014 guidance (**Table 8.6**), taking into account professional judgement.

Table 8.5: Criteria for Dust Emission Magnitude

Dust Emission Magnitude	Activity
Large	**Demolition** >50,000 m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks >10,000 m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8m high bunds formed, >100,000 tonnes material moved
	Construction >100,000 m^3 building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty soil type (e.g. clay), >100 m unpaved roads
Medium	**Demolition** 20,000 - 50,000 m^3 building demolished, dusty material (e.g. concrete) 10-20 m above ground level
	Earthworks 2,500 - 10,000 m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4 m – 8 m high bunds, 20,000 -100,000 tonnes material moved
	Construction 25,000 - 100,000 m^3 building volume, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material, 50 - 100 m unpaved roads

Dust Emission Magnitude	Activity
Small	**Demolition** <20,000 m^3 building demolished, non-dusty material, <10 m above ground level, work in winter
	Earthworks <2,500 m^2 site area, non-dusty soil, <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved
	Construction <25,000 m^3, non-dusty material
	Trackout <10 HDVs out / day, non-dusty soil, < 50m unpaved roads

Table 8.6: Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50 m 10 – 100 dwellings within 20 m Museums, car parks, car showrooms within 50m PM_{10} concentrations approach or are above the daily mean objective.	National or Internationally designated site within 20 m with dust sensitive features / species present.
Medium	>100 dwellings, hospitals, schools, care homes within 100m 10 – 100 dwellings within 50 m Less than 10 dwellings within 20 m Offices/shops/parks within 20m PM_{10} concentrations below the daily mean objective.	National or Internationally designated site within 50 m with dust sensitive features / species present. Nationally designated site or particularly important plant species within 20 m
Low	>100 dwellings, hospitals, schools, care homes 100 – 350 m away 10 – 100 dwellings within 50 – 350 m Less than 10 dwellings within 20 – 350 m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM_{10} concentrations well below the daily mean objective.	Nationally designated site or particularly important plant species 20 – 50 m. Locally designated site with dust sensitive features within 50 m.

8.3.13 Based on the dust emission magnitude and the area sensitivity, the risk of dust impacts is then determined (**Table 8.7**), taking into account professional judgement.

Table 8.7: Risk of Dust Impacts

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

8.3.14 Based on the risk of dust impacts, appropriate mitigation is selected from the IAQM 2014 guidance using professional judgement.

Operation

8.3.15 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1.1). The model requires the user to provide various input data, including the AADT flow, the proportion of heavy duty vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data suitable for the area of the study. Meteorological data for 2016 from the Brize Norton monitoring station was used in the assessment, as it is considered suitable for this area and is the closest meteorological station to the Application Site, approximately 28km away.

8.3.16 AADT flows and the proportions of HDVs for roads within 250 m of the proposed Application Site are summarised in **Appendix 12.2**. More detailed information about the traffic data used in this assessment is provided in **Chapter 6 – Transport and Access**. Traffic data has been provided for the following scenarios:

- Base Year 2016 (Baseline Scenario);
- Reference Case 2022 (Baseline 'Do Nothing' Scenario):
  - includes consented Heyford Park development; and
  - includes committed Local Plan/third party Application Sites.
- Application Test Case 2022 ('Do Something' Scenario):
  - includes consented Heyford Park development;
  - includes committed Local Plan / third party Application Sites; and
  - includes the proposed 297 dwellings as part of this application.
- Allocation Test Case 2031 (cumulative scenario):
  - as above in the Application Test Case, but includes the full Heyford Park allocation (1,600 residential units, 1,500 jobs).

8.3.17 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v8 which utilises NO_x emission factors taken from the European Environment Agency COPERT 5 emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model.

8.3.18 Application traffic data for the year 2022 have been combined with 2021 emission factors and background concentrations to provide a conservative worst-case assessment. **Appendix 8.3** contains a technical justification for the selection of emission factor year.

8.3.19 Nitrogen deposition has been calculated from the predicted nitrogen dioxide concentrations using a deposition velocity of 1.5 mm/s for grassland habitats.

Sensitive Locations – Human Health Receptors

8.3.20 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes, etc. When identifying these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

8.3.21 Based on the above criteria, eighteen existing properties have been identified as receptors for the assessment. These locations are described in **Table 8.8** and shown in **Figure 8.2**. The locations of existing residential receptors were chosen to represent locations where impacts from road traffic related to the Application are likely to be the greatest, i.e. as a result of Application traffic at junctions. Receptors were modelled at a height of 1.5 m representing ground floor exposure.

8.3.22 Concentrations have also been predicted at the roadside diffusion tubes located in close proximity to the Application Site, in order to verify the modelled results (see **Appendix 8.1** for further details on the verification method).

8.3.23 In addition, five receptors within the Site have been chosen as future residential receptors (PR1 – PR5), such proposed receptors were modelled at a height of 1.5 m representing ground floor exposure (shown in **Figure 8.2**)

Table 8.8: Description of Receptor Locations

Receptor	Location
R1	The White House, A4260, Hopcrofts Holt
R2	20 Bromeswell Close, Lower Heyford
R3	143 Freehold Street, Lower Heyford
R4	Cosie Cotte, Somerton Road, Upper Heyford
R5	Cotswold Lodge, Orchard Lane, Upper Heyford
R6	1 Ardley Road, Middleton Stoney
R7	Stonecroft, Station Road, Ardley
R8	2 Jersey Cottages, Station Road, Ardley
R9	Old Post Office, Heyford Road, Middleton Stoney
R10	Tinkers, Bicester Road, Middleton Stoney
R11	Corner Cottage Ardley Road, Middleton Stoney
R12	West of Ardley Road, Middleton Stoney
R13	2 Knowle Lane, Weston the Green
R14	The Darling, Rousham
R15	2, The Cottages, Oxford Road, North Aston
R16	The Fox, Oxford Road, North Aston
R17	Oxford Lodge, Tusmore
R18	66 Shannon Road, Bicester
PR1	Proposed residential receptor close to Kirtlington Road

Receptor	Location
PR2	Proposed residential receptor close to Kirtlington Road
PR3	Proposed residential receptor close to Kirtlington Road/Camp Road
PR4	Proposed residential receptor close to Camp Road
PR5	Proposed residential receptor close to Camp Road

Sensitive Locations – Ecological Receptors

8.3.24 The Ardley Cutting and Quarry SSSI is located adjacent to, and either side of the B430 Station Road north east of the Application Site. Two transects of receptors representing increasing distances (50-200 m) from the B430 have been modelled, one to the east (E1) and one to the west (E2) of the road. These receptor locations are shown in **Figure 8.2.**

8.3.25 The Critical Load Function Tool available from APIS was used to determine whether the acid deposition critical loads are exceeded.

Assessment of Significance

Construction

8.3.26 The construction impact significance criteria are based on the IAQM 2014 guidance. The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.

Operation

Human Health Receptors - Significance

8.3.27 There is no official guidance in the UK on how to assess the significance of air quality impacts of existing sources on a new development. The approach developed by Environmental Protection UK and the Institute of Air Quality Management's guidance document on Planning and Development Control[20] has therefore been used.

8.3.28 The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective.

8.3.29 **Table 8.9** sets out the impact magnitude descriptors, whilst **Table 8.10** sets out the impact descriptors.

[20] Moorcroft and Barrowcliffe et al. (2017). Land-use Planning & Development Control: Planning For Air Quality. V1.2. Institute of Air Quality Management, London

Table 8.9: Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude (Change in Concentration)	Annual Mean NO_2 and PM_{10}	Annual Mean $PM_{2.5}$	Annual Mean of 32 µg/m³ equating to 35 days above 50 µg/m³ for PM_{10}
Very Large	>3.8µg/m³	>2.375µg/m³	>3.04µg/m³
Large	>2.2 – ≤3.8µg/m³	>1.375 – ≤2.375µg/m³	>1.76 – ≤3.04µg/m³
Medium	>0.6 – ≤2.2µg/m³	>0.375 – ≤1.375µg/m³	>0.48 - ≤1.76µg/m³
Small	>0.2 - ≤0.6 µg/m³	>0.125 - ≤0.375µg/m³	>0.16 - ≤0.48 µg/m³
Imperceptible	≤0.2µg/m³	<0.125µg/m³	≤0.16µg/m³

Table 8.10: Impact Descriptor for Changes in Concentrations at a Receptor

Concentration with Development in place in relation to Objective / Limit Value	Change in concentration				
	Imperceptible	Small	Medium	Large	Very Large
> 110 % (a)	Negligible	Moderate	Major	Major	Major
>102% - ≤110% (b)	Negligible	Moderate	Moderate	Major	Major
>95% - ≤102% (c)	Negligible	Minor	Moderate	Moderate	Major
>75% - ≤95% (d)	Negligible	Negligible	Minor	Moderate	Moderate
≤75% (e)	Negligible	Negligible	Negligible	Minor	Moderate

Where concentrations increase the impact is described as adverse and where it decreases as beneficial.

(a) NO_2 or PM_{10}: >44 µg/m³ annual mean; $PM_{2.5}$ >27.5 µg/m³ annual mean; PM_{10} >35.2 µg/m³ annual mean (days)

(b) NO_2 or PM_{10}: >40.8 – ≤ 44 µg/m³ annual mean; $PM_{2.5}$ > 25.5 – ≤27.5 µg/m³ annual mean; PM_{10} >32.6 – ≤35.2 µg/m³ annual mean (days)

(c) NO_2 or PM_{10}: >38 – 40.8 µg/m³ annual mean; $PM_{2.5}$ >23.75 – ≤25.5 µg/m³ of annual mean; PM_{10} >30.4 – ≤32.6 µg/m³ annual mean (days)

(d) NO_2 or PM_{10}: >30 - ≤38 µg/m3 annual mean; PM2.5 >18.75 - ≤23.6 µg/m3 annual mean; PM10 <24 - ≤ 30.4 µg/m3 annual mean (days)

(e) NO2 or PM10: ≤30 µg/m3 annual mean; PM2.5 ≤18.75 µg/m3; annual mean; PM10 ≤24 µg/m3 annual mean (days)

8.3.30 The guidance states that the assessment of significance should be based on professional judgement, taking into account the following factors, with the overall air quality effects of the scheme described as either 'not significant', or of 'minor', 'moderate' or 'major' significance:

- Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance;

- The magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 8.9** and **8.10** findings;
- Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced;
- Uncertainty, including the extent to which worst-case assumptions have been made; and
- The extent to which an objective or limit value is exceeded.

8.3.31 Where impacts can be considered in isolation at an individual receptor, moderate or major impacts (i.e. per **Table 8.10**) may be considered to be a significant environmental effect, whereas negligible or minor impacts would not be considered significant. The overall effect however, needs to be considered in the round taking into account the changes at all of the modelled receptor locations, with a judgement made as to whether the overall air quality effect of the development is 'significant' or 'not significant', which is a binary judgement.

8.3.32 The significance of impacts within the Application Site is based on whether the NAQOs for each pollutant are exceeded or not.

Ecological Receptors – Significance

8.3.33 Where critical loads are already exceeded, an increase of more than 1% of the critical load is an indication of potentially significant effects which would trigger the need for further, more detailed assessment. It should be noted that an increase in deposition of more than 1% is not, per se, an indication that a significant effect exists, only the possibility of one. Depending on a more detailed assessment which would take account of the actual ecological conditions at the location under consideration, an increase of more than 1% may be acceptable.

Limitations to the Assessment

8.3.34 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

8.3.35 A disparity between the national road transport emission projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years[21]. Whilst projections suggest that both annual mean nitrogen oxides and nitrogen dioxide concentrations from road traffic emissions should have fallen by around 15-25% over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase. The monitoring carried out by CDC shows relatively stable concentrations in Ardley during the 2012-2016 period; the fact that concentrations have not fallen as rapidly as was previously anticipated means that a conservative approach needs to be adopted regarding future air quality predictions.

[21] Carslaw, D, Beevers, S, Westmoreland, E and Williams, M, 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Available at: http://uk-air.defra.gov.uk/library/reports?report_id=645

8.3.36 The future year road traffic modelling has been based on 2021 emission factors and background concentrations, whilst utilising future traffic flows for the year 2022. The model has been verified against 2016 monitoring data. This is considered to provide conservative assessment taking into account the uncertainties regarding future vehicle emission factors. Further information on the selection of future year emission factors is provided in **Appendix 8.3**.

8.4 BASELINE CONDITIONS

Baseline Survey Information

LAQM

8.4.1 Cherwell District Council (CDC) has investigated air quality within its area as part of its responsibilities under the LAQM regime. To date, four AQMAs have been declared within the district. None of them are in close proximity to the Application Site, the closest being located approximately 16 km away.

Monitoring

Nitrogen Dioxide

8.4.2 The Council operates an automatic monitoring station alongside Hennef Way in Banbury, which is not in close proximity to the Application Site. The Council also deploys nitrogen dioxide diffusion tubes at a number of locations. The closest monitoring locations are presented in **Table 8.11** and **Figure 8.3.**

Table 8.11: Measured Nitrogen Dioxide Concentrations, 2011-2015

Site ID	Site Type	Within AQMA	Annual Mean (µg/m^3)				
			2012	2013	2014	2015	2016
Ardley*	Roadside	N	30.9	26.9	30.7	29.6	28.7
Middleton Stoney*	Kerbside	N	-	-	34.1	32.4	33.3
Camp Road	Kerbside	N	-	-	15.8	14.1	14.9
Objective			**40**				

2012– 2016 Data taken from the 2017 Air Quality Annual Status Report[22]
* Used for model verification

8.4.3 The measured concentrations of nitrogen dioxide have been below the objectives at all three sites during the 2012-2016 period. There is no clear trend in concentrations over time.

Particulates (PM_{10} and $PM_{2.5}$)

8.4.4 There is no PM_{10} or $PM_{2.5}$ monitoring carried out in close proximity to the Application Site.

[22] Cherwell District Council (2017). *'Annual Air Quality Status Report for 2016'*.

Background Concentrations

8.4.5 In addition to measured concentrations, estimated background concentrations for the Application Site have been obtained from the national maps published by Defra (**Table 8.12**). The background concentrations are all well below the relevant objectives.

Table 8.12: Estimated Annual Mean Background Concentrations (µg/m^3)

Grid Square	NO_x		NO_2		PM_{10}		$PM_{2.5}$	
	2016	2021[b]	2016	2021[b]	2016	2021[b]	2016	2021[b]
455_230	14.1	10.7	10.6	8.2	15.2	14.7	9.9	9.4
446_228	9.1	7.5	7.0	5.8	13.4	12.9	8.9	8.5
446_229	9.0	7.4	6.9	5.7	13.3	12.9	8.8	8.5
447_223	9.3	7.6	7.2	5.9	13.0	12.6	8.7	8.3
449_224	10.2	8.3	7.8	6.4	13.9	13.4	9.2	8.8
449_225	10.1	8.2	7.7	6.3	12.8	12.4	8.7	8.3
450_225*	9.7	7.8	7.4	6.1	13.4	13.0	8.9	8.5
451_225*	9.9	8.0	7.6	6.2	13.6	13.2	9.1	8.7
452_226*	10.1	8.0	7.7	6.2	12.7	12.2	8.5	8.1
453_218	13.6	10.7	10.2	8.2	13.5	13.1	9.2	8.7
453_223	12.2	9.6	9.3	7.4	13.5	13.0	8.8	8.4
454_227	21.4	16.0	15.6	12.0	16.3	15.8	10.5	10.0
Objective	**30[a]**		**40**		**40**		**25**	

[a] NO_x objective in relation to ecological receptors only;
[b] 2021 data has been used for the assessment of the impact of Application and Allocation traffic in 2022 and 2031, respectively;
* Within Application Site.

Baseline Deposition – Ecological Receptors

8.4.6 The three-year Average (2013 – 2015) nitrogen and acid deposition rates for Ardley Cutting and Quarry SSSI sensitive to either nitrogen or acid deposition are presented in **Table 8.13**; data have been taken from the APIS website. The APIS data does not include future year predictions and therefore in a conservative basis, the APIS baseline is assumed constant for the future year assessments.

Table 8.13: Baseline Deposition Rates

Site	Habitat	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
			keqN/ha/yr	keqS/ha/yr
Ardley Cutting and Quarry SSSI	Calcareous grassland	21.14	1.51	0.19
Critical Level		**15 - 25**	**0.86 – 4.86**	**4.0**

Predicted Baseline Concentrations – Human Health Receptors

Existing Receptors

8.4.7 The ADMS-Roads model has been run to predict NO_2, PM_{10} and $PM_{2.5}$ concentrations at each of the existing receptor locations identified in **Table 8.8** for baseline years of 2016 and 2022 The results are presented in **Table 8.14**. The receptor locations are shown on **Figure 8.2**.

Table 8.14: Predicted Baseline Concentrations of NO_2, PM_{10} and $PM_{2.5}$ in 2016 and 2022

Receptor	Annual Mean (µg/m^3)					
	Baseline 2016			Future Baseline 2022		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	21.4	14.9	9.9	16.3	14.4	9.4
R2	13.2	14.5	9.6	10.8	14.1	9.2
R3	13.5	14.5	9.6	10.9	14.1	9.2
R4	13.3	13.4	9.1	11.6	13.2	8.7
R5	10.7	13.1	8.9	8.7	12.7	8.5
R6	37.3	16.4	10.8	29.0	15.9	10.1
R7	28.1	18.0	11.6	23.1	17.8	11.2
R8	27.5	17.9	11.5	22.6	17.7	11.1
R9	28.5	15.8	10.4	23.8	15.6	9.9
R10	27.7	15.6	10.2	23.4	15.4	9.8
R11	**42.6**	17.0	11.2	34.5	16.6	10.6
R12	27.4	15.7	10.2	21.5	15.2	9.7
R13	15.8	14.3	9.6	12.7	13.8	9.2
R14	8.2	13.2	8.8	7.4	12.8	8.4
R15	20.9	15.0	10.0	16.4	14.5	9.4
R16	18.9	14.8	9.8	14.8	14.2	9.3
R17	**41.2**	19.0	12.3	31.1	18.1	11.4
R18	17.1	14.5	9.7	15.4	14.1	9.3
Obj	**40**	**40**	**25**	**40**	**35**	**25**

Exceedance in bold. Obj=Objective

8.4.8 The annual mean objective for NO_2 is not predicted to be exceeded at any of the existing receptors locations in 2016 and 2022, with the exception of R11 (Corner Cottage, Ardley Road) and R17 (Oxford Lodge, Tusmore) where the objective is exceeded in 2016. Predicted baseline concentrations of PM_{10} and $PM_{2.5}$ are well below the objectives at all receptor locations for both years.

8.4.9 Whilst exceedances of the annual mean NO_2 objective is predicted at R11 and R17 in 2016, there are no AQMAs at these locations which may mean that the modelling is overpredicting baseline concentrations at these locations.

Predicted Baseline Concentrations – Ecological Receptors

8.4.10 Predicted concentrations and deposition rates for the baseline years 2016 and 2022 are presented in **Table 8.15**. Receptor locations are shown on **Figure 8.2**.

Table 8.15: Predicted Baseline Concentrations at Ecological Receptors in 2016 and 2022

Receptor and Distance in Habitat	Total NO_x (µg/m^3)		Nitrogen Deposition (kgN/ha/yr)		Acid Deposition (keqN/ha/yr)	
	2016	2022	2016	2022	2016	2022
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	**30.5**	23.3	**21.7**	**21.6**	1.737	1.733
E1 5m	**30.8**	23.6	**21.7**	**21.6**	1.739	1.735
E1 10m	**31.2**	23.9	**21.7**	**21.6**	1.741	1.736
E1 15m	**31.4**	24.1	**21.7**	**21.7**	1.742	1.737
E1 20m	**31.4**	24.2	**21.7**	**21.7**	1.742	1.738
E1 30m	**31.3**	24.0	**21.7**	**21.7**	1.741	1.737
E1 40m	**30.9**	23.7	**21.7**	**21.6**	1.739	1.735
E1 50m	**30.5**	23.4	**21.7**	**21.6**	1.737	1.733
E1 75m	29.6	22.6	**21.6**	**21.5**	1.733	1.729
E1 100m	28.9	22.0	**21.5**	**21.5**	1.729	1.726
E1 125m	28.4	21.6	**21.5**	**21.5**	1.726	1.723
E1 150m	28.0	21.2	**21.5**	**21.4**	1.724	1.721
E1 175m	27.7	20.9	**21.4**	**21.4**	1.722	1.720
E1 200m	27.4	20.7	**21.3**	**21.6**	1.721	1.718
Critical Level /Load	**30**		**15 [a]**		**0.856 – 4.856**	
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	**30.1**	20.7	**21.6**	**21.4**	1.735	1.731
E2 5m	**30.0**	23.0	**21.6**	**21.6**	1.734	1.731
E2 10m	29.9	22.9	**21.6**	**21.6**	1.734	1.730
E2 15m	29.7	22.8	**21.6**	**21.6**	1.733	1.729
E2 20m	29.5	22.7	**21.6**	**21.6**	1.732	1.729

Receptor and Distance in Habitat	Total NO_x ($\mu g/m^3$)		Nitrogen Deposition (kgN/ha/yr)		Acid Deposition (keqN/ha/yr)	
	2016	2022	2016	2022	2016	2022
E2 30m	29.2	22.5	**21.6**	**21.5**	1.730	1.727
E2 40m	28.8	22.2	**21.5**	**21.5**	1.728	1.725
E2 50m	28.4	21.9	**21.5**	**21.5**	1.726	1.723
E2 75m	27.7	21.6	**21.5**	**21.5**	1.722	1.720
E2 100m	27.2	21.0	**21.4**	**21.4**	1.719	1.718
E2 125m	15.0	20.5	**21.4**	**21.4**	1.718	1.716
E2 150m	14.8	12.0	**21.4**	**21.4**	1.716	1.715
E2 175m	14.5	11.7	**21.4**	**21.3**	1.715	1.713
E2 200m	14.3	11.5	**21.3**	**21.3**	1.714	1.713
Critical Level /Load	**30**		**15[a]**		**0.856 – 4.856**	

Exceedances in bold.
[a] minimal critical load

8.4.11 For Transect E1, to the east of Station Road, Ardley (see **Figure 8.2**), the NO_x critical level is predicted to be exceeded from 0m up to 50m from Station Road in 2016, whilst in 2022 the NO_x critical level is not predicted to be exceeded. The nitrogen deposition critical load is predicted to be exceeded at all receptor locations in 2016 and 2022. There are no predicted exceedances of the critical loads of acid deposition within the habitat in 2016 or 2022.

8.4.12 For Transect E2, to the west of Station Road, the NOx critical level is predicted to be exceeded from 0m and 5m from Station Road in 2016, whilst in 2022 the NOx critical level is not predicted to be exceeded. The nitrogen deposition critical load is predicted to be exceeded at all distances from Station Road in 2016 and 2031. There are no predicted exceedances of the critical loads of acid deposition within the habitats in 2016 and 2031.

8.4.13 The decrease in concentrations and deposition between 2016 and 2022 is a result of vehicle emissions reducing at a greater rate than baseline traffic levels increase over the same time period, notwithstanding the fact that vehicle emission factors for 2021 have been used for the full year assessment.

8.5 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

Construction Effects – Human Health Receptors

8.5.1 The main potential effects during construction are dust deposition and elevated PM_{10} concentrations. The following activities have the potential to cause emissions of dust:

- site preparation including delivery of construction material, erection of fences and barriers;
- demolition of existing buildings on site;
- earthworks including digging foundations and landscaping;
- materials handling such as storage of material in stockpiles and spillage;
- construction and fabrication of units; and
- disposal of waste materials off-site.

8.5.2 Typically the main cause of unmitigated dust generation on construction sites is from demolition and vehicles using unpaved haul roads, and off-site from the suspension of dust from mud deposited on local roads by construction traffic. The main determinants of unmitigated dust annoyance are the weather and the distance to the nearest receptor.

8.5.3 Based on the IAQM criteria (**Table 8.5**), the dust emission magnitude is considered to be high. The study area is considered to be of medium sensitivity (**Table 8.6**). Appropriate mitigation corresponding to a medium risk site is therefore required during the construction phase (**Table 8.7**).

Construction Effects- Ecological Receptors

8.5.4 Ardley Cutting and Quarry SSSI is located approximately 3.5km from the Proposed Application Site. Given the large distance between the Site and the ecological habitats there are no foreseen construction dust effects on the SSSI.

Effect Significance

8.5.5 In accordance with the IAQM criteria, with mitigation in place, the effect of construction phase dust is not significant.

Road Traffic Effects – Human Health Receptors

Existing Receptors

8.5.6 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors in 2022 both without and with the Application in place are presented in **Table 8.16.**

Table 8.16: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ for Existing Receptors

Receptor	Annual Mean (µg/m^3)					
	Reference Case 2022			Application Test Case 2022		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	16.3	14.4	9.4	16.4	14.4	9.4
R2	10.8	14.1	9.2	11.0	14.1	9.2
R3	10.9	14.1	9.2	11.1	14.1	9.2
R4	11.6	13.2	8.7	12.2	13.2	8.8
R5	8.7	12.7	8.5	8.9	12.7	8.5
R6	29.0	15.9	10.1	29.2	15.9	10.2
R7	23.1	17.8	11.2	23.7	17.9	11.2
R8	22.6	17.7	11.1	23.1	17.8	11.2
R9	23.8	15.6	9.9	24.4	15.7	10.0
R10	23.4	15.4	9.8	23.7	15.4	9.8
R11	34.5	16.6	10.6	35.0	16.7	10.7
R12	21.5	15.2	9.7	21.6	15.2	9.7
R13	12.7	13.8	9.2	12.8	13.8	9.2
R14	7.4	12.8	8.4	7.6	12.9	8.5

Receptor	Annual Mean (μg/m³)					
	Reference Case 2022			Application Test Case 2022		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R15	16.4	14.5	9.4	16.5	14.5	9.4
R16	14.8	14.2	9.3	14.9	14.3	9.3
R17	31.1	18.1	11.4	31.2	18.1	11.4
R18	15.4	14.1	9.3	15.5	14.2	9.3
Obj	**40**	**40**	**25**	**40**	**40**	**25**

Obj=Objective

8.5.7 Predicted concentrations are below the objectives in 2022 with and without the Application in place at all receptor locations.

8.5.8 The changes in annual mean concentrations are presented in **Table 8.17**, based on unrounded numbers.

Table 8.17: Change in Predicted Concentrations brought about by the Application Site

Receptor	Annual Mean (μg/m³)		
	NO_2	PM_{10}	$PM_{2.5}$
R1	0.1	0.0	0.0
R2	0.3	0.0	0.0
R3	0.2	0.0	0.0
R4	0.6	0.1	0.1
R5	0.2	0.0	0.0
R6	0.2	0.0	0.0
R7	0.5	0.1	0.1
R8	0.5	0.1	0.1
R9	0.7	0.1	0.1
R10	0.3	0.0	0.0
R11	0.5	0.1	0.0
R12	0.2	0.0	0.0
R13	0.1	0.0	0.0
R14	0.3	0.0	0.0
R15	0.1	0.0	0.0
R16	0.1	0.0	0.0
R17	0.2	0.0	0.0
R18	0.1	0.0	0.0

8.5.9 Based on the impact magnitude descriptors in **Table 8.9**, the changes in annual mean nitrogen dioxide concentrations range from imperceptible to medium with the

Application in place, and the changes in PM_{10} and $PM_{2.5}$ concentrations are all imperceptible.

8.5.10 Using the criteria set out in **Table 8.10**, the impact on NO_2, PM_{10} and $PM_{2.5}$ concentrations is described as negligible.

Proposed Receptors

8.5.11 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at proposed residential receptors within the Site in 2022 are presented in **Table 8.18**.

Table 8.18: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Proposed Receptors within the Application Site

Receptor	Annual Mean (µg/m³)		
	NO_2	PM_{10}	$PM_{2.5}$
PR1	7.3	13.1	8.6
PR2	7.5	13.2	8.7
PR3	8.7	13.4	8.8
PR4	8.9	13.6	8.9
PR5	9.0	13.6	8.9
Objective	**40**	**40**	**25**

8.5.12 Predicted Concentrations at worst case proposed receptor locations are well below the objectives and therefore the whole site is considered suitable for future residents of the Application.

Effect Significance

8.5.13 The air quality effects of road traffic generated by the Application site are considered to be not significant as there are no predicted exceedances at any of the assessed receptor locations in the assessment year (2022). This judgement is made based on the assessment criteria set out in **paragraph 8.3.30**, in particular, that a conservative assessment has been carried out.

Road Traffic Effects – Ecological Receptors

8.5.14 Predicted concentrations and deposition rates without and with the Application in place are contained in **Table 8.19**.

Table 8.19: Predicted Concentrations at Ecological Receptors in 2022 without and with the Application

Receptor and Distance in Habitat	Reference Case 2022			Application Test Case 2022		
	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	23.3	**21.6**	1.733	23.6	**21.6**	1.735

Receptor and Distance in Habitat	Reference Case 2022			Application Test Case 2022		
	Total NO_x ($\mu g/m^3$)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x ($\mu g/m^3$)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
E1 5m	23.6	**21.6**	1.735	24.0	**21.7**	1.737
E1 10m	23.9	**21.6**	1.736	24.3	**21.7**	1.738
E1 15m	24.1	**21.7**	1.737	24.5	**21.7**	1.739
E1 20m	24.2	**21.7**	1.738	24.5	**21.7**	1.740
E1 30m	24.0	**21.7**	1.737	24.4	**21.7**	1.739
E1 40m	23.7	**21.6**	1.735	24.1	**21.7**	1.737
E1 50m	23.4	**21.6**	1.733	23.7	**21.6**	1.735
E1 75m	22.6	**21.5**	1.729	22.9	**21.6**	1.731
E1 100m	22.0	**21.5**	1.726	22.3	**21.5**	1.727
E1 125m	21.6	**21.5**	1.723	21.8	**21.5**	1.725
E1 150m	21.2	**21.4**	1.721	21.4	**21.5**	1.722
E1 175m	20.9	**21.4**	1.720	21.1	**21.4**	1.721
E1 200m	20.7	**21.4**	1.718	20.8	**21.4**	1.719
Critical Level / Load	**30**	**15** [a]	**0.856 – 4.856**	**30**	**15** [a]	**0.856 – 4.856**
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	23.0	**21.6**	1.731	23.3	**21.6**	1.733
E2 5m	22.9	**21.6**	1.731	23.2	**21.6**	1.732
E2 10m	22.8	**21.6**	1.730	23.1	**21.6**	1.732
E2 15m	22.7	**21.6**	1.729	23.0	**21.6**	1.731
E2 20m	22.5	**21.5**	1.729	22.8	**21.6**	1.730
E2 30m	22.2	**21.5**	1.727	22.5	**21.5**	1.728
E2 40m	21.9	**21.5**	1.725	22.1	**21.5**	1.726
E2 50m	21.6	**21.5**	1.723	21.8	**21.5**	1.725

Receptor and Distance in Habitat	Reference Case 2022			Application Test Case 2022		
	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
E2 75m	21.0	**21.4**	1.720	21.2	**21.4**	1.721
E2 100m	20.5	**21.4**	1.718	20.7	**21.4**	1.718
E2 125m	12.0	**21.4**	1.716	12.1	**21.4**	1.717
E2 150m	11.7	**21.3**	1.715	11.9	**21.4**	1.715
E2 175m	11.5	**21.3**	1.713	11.7	**21.3**	1.714
E2 200m	11.4	**21.3**	1.713	11.5	**21.3**	1.713
Critical Level / Load	**30**	**15 [a]**	**0.856 – 4.856**	**30**	**15 [a]**	**0.856 – 4.856**

Exceedances in bold.
[a] Minimal critical load

8.5.15 The changes in the total NO_x nitrogen deposition and acid deposition brought about by the Application are presented in **Table 8.20**.

Table 8.20: Predicted Application Site Contribution in 2022

Receptor and Distance in Habitat	Application Test Case 2022					
	Total NO_x (µg/m³)		Nitrogen Deposition (kgN/ha/yr)		Acid Deposition (keqN/ha/yr)	
	NO_x	%	N Deposition	%	Acid Deposition	%
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	0.3	1.1	0.02	0.2	0.002	0.0
E1 5m	0.3	1.1	0.03	0.2	0.002	0.0
E1 10m	0.4	1.2	0.03	0.2	0.002	0.0
E1 15m	0.4	1.2	0.03	0.2	0.002	0.0
E1 20m	0.4	1.2	0.03	0.2	0.002	0.0
E1 30m	0.4	1.2	0.03	0.2	0.002	0.0
E1 40m	0.3	1.1	0.03	0.2	0.002	0.0
E1 50m	0.3	1.1	0.02	0.2	0.002	0.0
E1 75m	0.3	0.9	0.02	0.2	0.002	0.0

Receptor and Distance in Habitat	Application Test Case 2022					
	Total NO_x (µg/m³)		Nitrogen Deposition (kgN/ha/yr)		Acid Deposition (keqN/ha/yr)	
	NO_x	%	N Deposition	%	Acid Deposition	%
E1 100m	0.3	0.8	0.02	0.1	0.001	0.0
E1 125m	0.2	0.8	0.02	0.1	0.001	0.0
E1 150m	0.2	0.7	0.02	0.1	0.001	0.0
E1 175m	0.2	0.6	0.02	0.1	0.001	0.0
E1 200m	0.2	0.6	0.01	0.1	0.001	0.0
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	0.3	1.0	0.02	0.2	0.002	0.0
E2 5m	0.3	1.0	0.02	0.2	0.002	0.0
E2 10m	0.3	1.0	0.02	0.1	0.002	0.0
E2 15m	0.3	1.0	0.02	0.2	0.002	0.0
E2 20m	0.3	0.9	0.02	0.1	0.002	0.0
E2 30m	0.3	0.9	0.02	0.1	0.001	0.0
E2 40m	0.2	0.8	0.02	0.1	0.001	0.0
E2 50m	0.2	0.8	0.02	0.1	0.001	0.0
E2 75m	0.2	0.6	0.01	0.1	0.001	0.0
E2 100m	0.2	0.6	0.01	0.1	0.001	0.0
E2 125m	0.2	0.5	0.01	0.1	0.001	0.0
E2 150m	0.1	0.5	0.01	0.1	0.001	0.0
E2 175m	0.1	0.4	0.01	0.1	0.001	0.0
E2 200m	0.1	0.4	0.01	0.1	0.001	0.0

8.5.16 For both transects E1 and E2, the nitrogen deposition critical load is predicted to be exceeded at all distances from Station Road both and without the Application in place. The increase in nitrogen deposition is less than 1% and is therefore insignificant. There are no predicted exceedances of the NO_x critical level or acid deposition critical load within either of the transects in 2022 with the Application in place.

8.5.17 The assessment has been undertaken assuming that background deposition rates remain unchanged from current rates. Future reductions in vehicle emissions are expected to reduce background deposition rates.

Effect Significance

8.5.18 The air quality effects on human health of road traffic generated by the Application are considered to be not significant as there are no predicted exceedances at any of the assessed human health receptor locations in 2022. This judgement is made based on the assessment criteria set out in **paragraph 8.3.30**, in particular, that a conservative assessment has been carried out.

8.5.19 The air quality effects on ecological habitats of road traffic generated by the Application are considered to be not significant as the increase of nitrogen deposition is less than 1% at all of the assessed ecological receptor locations. This judgement is made based on the assessment criteria set out in **paragraph 8.3.30**, in particular, that a conservative assessment has been carried out.

8.6 MITIGATION AND ENHANCEMENT

Construction

8.6.1 The following standard medium risk mitigation measures from the IAQM 2014 guidance are recommended. These will be included within a Construction Environmental Management Plan (CEMP) and agreed with Local Authority. With these mitigation measures in place, the significance of construction effects is insignificant.

Communication

- Develop and implement a stakeholder communications plan;
- Display the name and contact details of persons accountable on the site boundary;
- Display the head or regional office information on the site boundary.

Management

- Develop and implement a dust management plan.
- Record all dust and air quality complaints, identify causes and take measures to reduce emissions.
- Record exceptional incidents and action taken to resolve the situation.
- Carry out regular site inspections to monitor compliance with the dust management plan and record results.
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site run off of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove potentially dusty materials from site as soon as possible.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Ensure all vehicles switch off engines when stationary.
- Avoid the use of diesel or petrol powered generators where possible.

- Produce a Construction Logistics Plan to manage the delivery of goods and materials.
- Only use cutting, grinding and sawing equipment with dust suppression equipment.
- Ensure an adequate supply of water on site for dust suppressant.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.
- Ensure equipment is readily available on site to clean up spillages of dry materials.
- No on-site bonfires and burning of waste materials on site.

Earthworks

- Re-vegetate earthworks and exposed areas /soil stockpiles to stabilise surfaces as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

Demolition

- Incorporate soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
- Ensure water suppression is used during demolition operation;
- Avoid explosive blasting, using appropriate manual and mechanical alternatives; and
- Bag and remove any biological debris or damp down such material before demolition.

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored silos with suitable emissions control systems

Trackout

- Use water assisted dust sweepers on the site access and local roads;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials;
- Record inspection of on-site haul routes and any subsequent action, repairing as soon as reasonably practicable;
- Install hard surfaced haul routes which are regularly damped down; and
- Install a wheel wash with a hard-surfaced road to the site exit where site layout permits.
- The site access gate to be located at least 10m from receptors where possible.

Operation

8.6.2 The effects of the Application traffic are judged to be not significant, given the conservative nature of the assessment. No additional traffic mitigation other than that set out in the Transport Chapter is proposed.

8.6.3 Mitigation summary is presented in **Table 8.21** below.

Table 8.21: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Condition
1	Construction Phase Mitigation in CEMP			X
2	Operational Phase Mitigation	X		

8.7 CUMULATIVE AND IN-COMBINATION EFFECTS

Construction

8.7.1 Cumulative construction dust effects could potentially occur should construction of the cumulative schemes in the vicinity of the Application Site occur at the same time. However, significant cumulative effects are unlikely to occur as each development is anticipated to employ similar dust mitigation techniques such that the individual construction phase effect is not significant, alone or in combination with other schemes.

Operation

8.7.2 The traffic data used takes into account cumulative developments in the area. However, an additional traffic scenario has been used to assess the cumulative air quality effects of the full Heyford Park Allocation, in addition to the Application Site. Modelling of the effects of the Allocation has been based on the cumulative 2031 Allocation Test Scenario traffic data which includes the following:

- Appropriate levels of background growth;
- Consented Heyford Park development (1,178 residential units and 1,700 jobs);
- Committed Local Plan/third party development sites (North West Bicester, Kingsmere, Network Bicester, and Bicester Gateway); and
- The full Site Allocation (1,600 residential units, 1,500 jobs).

8.7.3 The cumulative scenario follows the same methodology and assesses 2031 traffic data combined with 2021 emission factors and background concentrations to provide a conservative assessment of likely significant effects.

Existing Receptors

8.7.4 Concentrations have been predicted at existing receptor locations in 2031 with the Application in place and for the 2031 Allocation Test Scenario. The results are presented in **Table 8.22**.

Table 8.22: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$

Receptor	Annual Mean (µg/m³)					
	2031 Baseline (with Application)			2031 Allocation Test		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	17.3	14.5	9.4	18.2	14.6	9.5
R2	11.2	14.1	9.2	13.8	14.5	9.4
R3	11.3	14.2	9.2	13.7	14.5	9.4

Receptor	Annual Mean (µg/m³)					
	2031 Baseline (with Application)			2031 Allocation Test		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R4	12.0	13.2	8.8	17.5	14.0	9.2
R5	8.9	12.8	8.5	10.4	13.0	8.6
R6	32.9	16.4	10.5	34.4	16.7	10.6
R7	24.5	17.9	11.2	29.6	18.9	11.8
R8	23.8	17.8	11.2	28.8	18.7	11.7
R9	26.0	15.9	10.1	31.0	16.8	10.6
R10	27.6	16.0	10.2	30.0	16.4	10.4
R11	39.2	17.4	11.1	**42.9**	18.0	11.4
R12	24.2	15.6	10.0	25.3	15.8	10.1
R13	13.4	13.9	9.2	14.3	14.0	9.3
R14	7.4	12.8	8.4	9.5	13.1	8.6
R15	17.4	14.6	9.5	18.9	14.8	9.6
R16	15.7	14.4	9.4	16.9	14.5	9.5
R17	33.5	18.5	11.7	35.3	18.7	11.8
R18	18.4	14.6	9.5	19.5	14.7	9.6
Obj	**40**	**40**	**25**	**40**	**40**	**25**

Exceedances highlighted in bold; Obj=Objective

8.7.5 The changes in annual mean concentrations between Application and the 2031 Allocation test scenario are presented in **Table 8.23**, based on unrounded numbers.

Table 8.23: Change in Predicted Concentration brought about by the Allocation scenario in the 2031

Receptor	Annual Mean (µg/m³)		
	NO_2	PM_{10}	$PM_{2.5}$
R1	0.9	0.1	0.1
R2	2.6	0.4	0.2
R3	2.4	0.4	0.2
R4	5.5	0.8	0.5

Receptor	Annual Mean (μg/m³)		
	NO_2	PM_{10}	$PM_{2.5}$
R5	1.5	0.2	0.1
R6	1.6	0.2	0.1
R7	5.2	0.9	0.5
R8	5.0	0.9	0.5
R9	5.0	0.8	0.5
R10	2.4	0.4	0.2
R11	3.7	0.6	0.4
R12	1.1	0.2	0.1
R13	0.9	0.1	0.1
R14	2.1	0.3	0.2
R15	1.5	0.2	0.1
R16	1.2	0.2	0.1
R17	1.8	0.2	0.1
R18	1.1	0.2	0.1

8.7.6 Based on the impact magnitude descriptors in **Table 8.9**, the changes in annual mean NO_2 concentrations range from medium to very large. The following receptors are predicted to have a very large change in nitrogen dioxide concentrations: R4, R7, R8 and R9, whilst a large change in concentrations is predicted at R2, R3, R10 and R11 (see **Table 8.8** and **Figure 8.2** for a description of receptor locations). A medium change in NO_2 concentrations is predicted at the remaining receptors.

8.7.7 The changes in PM_{10} concentrations range from imperceptible to medium. A medium change in PM_{10} concentrations is predicted at the following receptors: R4, R7, R8, R9. Receptors R2, R3, R5, R6, R10, R11, R14, R15 and R17 are predicted to experience a small change in PM_{10} concentrations. The remaining receptors are predicted to experience an imperceptible change in PM_{10} concentrations.

8.7.8 Changes in $PM_{2.5}$ concentrations are predicted to range from imperceptible to medium. A medium change is predicted at R4, R7, R8 and R9 and a small change at R2, R3, R6, R10, R11, R14, R15 and R17. An imperceptible change is predicted at the remaining receptors.

8.7.9 Using the criteria set out in **Table 8.10,** the impacts on NO_2 concentrations at R11 are described as **major adverse** due to the exceedance of the objective as a result of the Allocation traffic. The impacts at R4, R7, R8 and R9 are described as **moderate adverse,** whilst at R2, R3, R6, R10 and R17 the impacts are described as minor adverse. Impacts on the remaining receptors are described as negligible. Impacts on PM_{10} and $PM_{2.5}$ concentrations at all receptor locations are all described as negligible.

8.7.10 An additional set of modelling has been undertaken as part of the sensitivity test to illustrate the effects of changes in vehicle emission factors on the predicted concentrations. The sensitivity test modelling uses the same cumulative 2031 traffic data, but uses the 2022 emission factors and background concentrations rather than 2021. The results of the cumulative scenario sensitivity test are shown in **Table 8.24**.

Table 8.24: Effect of Change in Emission Factor Years

Receptor	Annual Mean (µg/m^3)					
	2031 Baseline (with Application and 2021 Emission Factors)			2031 Allocation Scenario (2022 Emission Factors)		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	17.3	14.5	9.4	16.8	14.5	9.4
R2	11.2	14.1	9.2	12.9	14.5	9.4
R3	11.3	14.2	9.2	12.8	14.5	9.4
R4	12.0	13.2	8.8	16.3	14.0	9.2
R5	8.9	12.8	8.5	9.8	12.9	8.6
R6	32.9	16.4	10.5	31.7	16.6	10.5
R7	24.5	17.9	11.2	27.5	18.8	11.7
R8	23.8	17.8	11.2	26.7	18.6	11.6
R9	26.0	15.9	10.1	28.7	16.7	10.6
R10	27.6	16.0	10.2	27.7	16.3	10.4
R11	39.2	17.4	11.1	39.6	17.9	11.3
R12	24.2	15.6	10.0	23.4	15.7	10.0
R13	13.4	13.9	9.2	13.4	14.0	9.3
R14	7.4	12.8	8.4	9.0	13.1	8.6
R15	17.4	14.6	9.5	17.5	14.8	9.6
R16	15.7	14.4	9.4	15.7	14.5	9.4
R17	33.5	18.5	11.7	32.5	18.7	11.7
R18	18.4	14.6	9.5	18.1	14.7	9.6
Objective	**40**	**40**	**25**	**40**	**40**	**25**

Exceedances highlighted in bold. Annual mean expressed in µg/m^3

8.7.11 **Table 8.24** shows that with the Allocation Developments in place the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the objectives in 2031 at all receptor locations assuming 2022 vehicle emission factors.

Proposed Receptors

8.7.12 Concentrations at proposed receptor locations within the 2031 Allocation Test Scenario are presented in **Table 8.25**.

Table 8.25: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Proposed Receptors in the 2031 Allocation Test Scenario

Receptor	Annual Mean 2031 Allocation Test Scenario (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$
PR1	8.0	13.2	8.7
PR2	8.5	13.3	8.8
PR3	10.8	13.7	9.0
PR4	10.7	13.9	9.1
PR5	10.8	13.9	9.1
Obj	**40**	**40**	**25**

Exceedances highlighted in bold. Obj=Objective

8.7.13 Predicted concentrations in 2031 at receptor locations within the Application Site are well below the relevant objectives. The Application Site is therefore considered suitable for the proposed mixed-use development.

Effect Significance

8.7.14 The predicted Allocation Test Scenario traffic NO_2 concentrations with emission factors one year later than the opening year are all lower than the air quality objectives. Taking into account the temporary nature of the effect, and the use of Allocation Test Scenario traffic for the opening year of the assessment, the air quality effects of road traffic generated by the Application and Allocation developments are considered to be not significant. This judgement is also based upon the assessment criteria set out in **paragraph 8.3.30**, in particular, that a conservative assessment has been carried out.

Ecological Receptors

8.7.15 Predicted concentrations and deposition rates with the Application in place, and with the 2031 Allocation Test Scenario, are contained in **Table 8.26**.

Table 8.26: Predicted Concentrations at Ecological Receptors in 2031

Receptor and Distance in Habitat	2031 Baseline (With Application)			2031 Allocation Test Scenario		
	Total NO_x ($\mu g/m^3$)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x ($\mu g/m^3$)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	24.2	**21.7**	1.738	27.5	**21.9**	1.756
E1 5m	24.5	**21.7**	1.740	28.0	**22.0**	1.758
E1 10m	24.9	**21.7**	1.742	28.5	**22.0**	1.761
E1 15m	25.1	**21.7**	1.743	28.8	**22.0**	1.763
E1 20m	25.1	**21.7**	1.743	28.8	**22.0**	1.763
E1 30m	25.0	**21.7**	1.742	28.6	**22.0**	1.762
E1 40m	24.6	**21.7**	1.740	28.1	**22.0**	1.759
E1 50m	24.3	**21.7**	1.738	27.5	**21.9**	1.756
E1 75m	23.4	**21.6**	1.733	26.3	**21.8**	1.749
E1 100m	22.7	**21.6**	1.729	25.3	**21.8**	1.744
E1 125m	22.2	**21.5**	1.727	24.5	**21.7**	1.739
E1 150m	21.7	**21.5**	1.724	23.9	**21.6**	1.736
E1 175m	21.4	**21.5**	1.723	23.4	**21.6**	1.734
E1 200m	21.1	**21.4**	1.721	23.0	**21.6**	1.731
Critical Level / Load	**30**	**15[a]**	**0.856 – 4.856**	**30**	**15[a]**	**0.856 – 4.856**
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	23.8	**21.6**	1.736	26.9	**21.9**	1.753
E2 5m	23.7	**21.6**	1.735	26.8	**21.9**	1.752
E2 10m	23.6	**21.6**	1.735	26.6	**21.9**	1.751
E2 15m	23.5	**21.6**	1.734	26.4	**21.8**	1.750
E2 20m	23.3	**21.6**	1.733	26.1	**21.8**	1.748
E2 30m	22.9	**21.6**	1.731	25.6	**21.8**	1.745
E2 40m	22.5	**21.5**	1.729	25.0	**21.7**	1.742
E2 50m	22.2	**21.5**	1.727	24.5	**21.7**	1.739
E2 75m	21.5	**21.5**	1.723	23.5	**21.6**	1.734

Receptor and Distance in Habitat	2031 Baseline (With Application)			2031 Allocation Test Scenario		
	Total NO_x (μg/m^3)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (μg/m^3)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
E2 100m	21.0	**21.4**	1.720	22.7	**21.6**	1.730
E2 125m	12.4	**21.4**	1.718	14.0	**21.5**	1.727
E2 150m	12.1	**21.4**	1.717	13.6	**21.5**	1.725
E2 175m	11.9	**21.4**	1.715	13.2	**21.5**	1.723
E2 200m	11.7	**21.3**	1.714	13.0	**21.4**	1.722
Critical Level / Load	**30**	**15[a]**	**0.856 – 4.856**	**30**	**15[a]**	**0.856 – 4.856**

Exceedances in bold.
[a] Minimal critical load

8.7.16 The changes in the total NO_x nitrogen deposition and acid deposition brought about by the Application and Allocation developments are presented in **Table 8.27**.

Table 8.27: Predicted Allocation Contribution in 2031

Receptor and Distance in Habitat	2031 Allocation Test Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	(μg/m^3)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	3.3	11.0	0.25	1.7	0.018	0.4
E1 5m	3.5	11.5	0.26	1.7	0.019	0.4
E1 10m	3.6	12.0	0.27	1.8	0.020	0.4
E1 15m	3.7	12.3	0.28	1.9	0.020	0.4
E1 20m	3.7	12.3	0.28	1.9	0.020	0.4
E1 30m	3.6	12.0	0.27	1.8	0.020	0.4
E1 40m	3.4	11.5	0.26	1.7	0.019	0.4
E1 50m	3.3	10.9	0.25	1.7	0.018	0.4
E1 75m	2.9	9.6	0.22	1.5	0.016	0.3
E1 100m	2.6	8.6	0.20	1.3	0.014	0.3
E1 125m	2.3	7.8	0.18	1.2	0.013	0.3
E1 150m	2.1	7.2	0.17	1.1	0.012	0.2
E1 175m	2.0	6.6	0.15	1.0	0.011	0.2

Receptor and Distance in Habitat	2031 Allocation Test Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	($\mu g/m^3$)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
E1 200m	1.9	6.2	0.14	1.0	0.010	0.2
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	3.1	10.4	0.24	1.6	0.017	0.4
E2 5m	3.1	10.2	0.23	1.6	0.017	0.3
E2 10m	3.0	10.1	0.23	1.5	0.016	0.3
E2 15m	2.9	9.8	0.22	1.5	0.016	0.3
E2 20m	2.9	9.5	0.22	1.5	0.016	0.3
E2 30m	2.7	8.9	0.20	1.4	0.015	0.3
E2 40m	2.5	8.3	0.19	1.3	0.014	0.3
E2 50m	2.3	7.8	0.18	1.2	0.013	0.3
E2 75m	2.0	6.7	0.16	1.0	0.011	0.2
E2 100m	1.8	5.9	0.14	0.9	0.010	0.2
E2 125m	1.6	5.4	0.13	0.9	0.009	0.2
E2 150m	1.5	4.9	0.12	0.8	0.008	0.2
E2 175m	1.4	4.6	0.11	0.7	0.008	0.2
E2 200m	1.3	4.3	0.10	0.7	0.007	0.2

8.7.17 For both transects E1 and E2, the nitrogen deposition critical load is predicted to be exceeded at all distances from Station Road with the Allocation Test Scenario in place. For transect E1, the increase in nitrogen deposition is 1% of the critical load from 0-150m from the road. For transect E2, the increase in nitrogen deposition is 1% of the critical load from 0-50m from the road. Therefore, the increase in nitrogen deposition is potentially significant across these distances for E1 and E2. However, the maximum increase in deposition is only 1.9% of the critical load, and the area across E1 and E2 combined where the increase is above 1% of the critical load is only approximately 3.4% of the total area of the habitat.

8.7.18 There are no predicted exceedances of the critical level for NO_x or critical load for acid deposition within the habitat in 2031 with Allocation developments in place.

8.7.19 The assessment has been undertaken assuming that background deposition rates remain unchanged from current rates. Future reductions in vehicle emissions are expected to reduce background deposition rates.

Effect Significance

8.7.20 On ecological habitats, air quality effects of road traffic generated by the Allocation Test Scenario are considered to be not significant as the increase of nitrogen deposition is a maximum of 1.9% of the critical load, and only more than 1% for 3.4% of the total habitat area. In addition, the deposition is dominated by the assumed baseline rate. This judgement is made based on the assessment criteria set out in **paragraph 8.3.30**, in particular, that a conservative assessment has been carried out.

8.8 MONITORING

8.8.1 No monitoring is deemed necessary to ensure that effective mitigation is maintained.

8.9 CONCLUSIONS

8.9.1 The assessment has demonstrated that with the use of appropriate mitigation measures, the Application Site is suitable for development and would not result in any significant air quality effects. There are no air quality constraints to the Application.

8.10 SUMMARY

8.10.1 The effects of the Application traffic are judged to be not significant. No additional traffic mitigation is therefore required overall above embedded mitigation.

8.10.2 **Table 8.28** provides a summary of the effects, mitigation and residual effects in terms of Air Quality.

Table 8.28: Summary of Effects, Mitigation and Residual Effects (Air Quality)

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
Construction								
Existing residential receptors	Dust deposition and elevated PM_{10} concentrations.	Temporary	NA	NA	L	NA	Standard medium risk mitigation measures from the IAQM 2014 guidance to be applied through CEMP	Not significant
Operation								
Existing and proposed residential receptors	Elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant
Ecological receptors	Elevated NO_x and acid deposition from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
Cumulative and In-combination								
Operational								
Emissions of NO_2, PM_{10} and $PM_{2.5}$ from operational traffic	Elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant
Ecological receptors	Elevated NO_x and acid deposition from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant

Term	Description
AADT	Annual Average Daily Traffic.
Acid Deposition	The mix of air pollutants that deposit from the atmosphere leading to acidification of soils and freshwater.
ADMS-Roads	Atmospheric Dispersion Modelling System – Roads. A dispersion modelling software used for calculating emissions of atmospheric pollutants from road sources.
Air Quality (England) Amendment Regulations (2002)	Amendment regulations to the Air Quality Regulations (2000) which prescribe the National Air Quality Objectives for Local Air Quality Management.
Air Quality Strategy (2007)	Establishes the policy framework for ambient air quality management and assessment in the UK.
Air Quality Standard Regulations (2010)	Implements the European Union Directive on Ambient Air Quality and Cleaner Air for Europe (2008/50/EC) which sets limit values for certain air pollutants. The NAQ
APIS	Air Pollution Information System. Provides a comprehensive source of information on air pollution and the effects on habitats and species.
AQAP	Air Quality Action Plan. A plan required under Local Air Quality Management when an air quality management area is designated. The plans outline the measures to be taken by the Local Authority to improve air quality within the area of concern.
AQMA	Air Quality Management Area. A designated area under the Local Air Quality Management process where the National Air Quality Objectives are not being achieved.
COPERT 5	A Microsoft Windows programme developed as a European tool for the calculation of emissions from the road transport sector.
Critical Level	A concentration of a specific pollutant that, when exceeded, direct adverse effects on receptors such as humans, plants and ecosystems may occur.
Critical Load	The amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.
Critical Load Function Tool	The tool calculates the significance of a process contribution by comparing acid deposition to the critical load function. Available from the Air Pollution Information System website.
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
EC	European Commission
EFT	Emission Factor Toolkit. A tool created by Defra which is used in the calculation of emissions from road sources.
Environment Act 1995	Part IV introduced the system of Local Air Quality Management which requires local authorities to review and assess air quality within their boundary.

EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle. A vehicle with a gross weight greater than 3.5 tonnes – includes HGVs and buses
LAQM	Local Air Quality Management. The framework introduced by Part IV of the Environment Act 1995 under which Local Authorities have a duty to review and assess air quality within their boundary.
LDV	Light Duty Vehicle
NAQO	National Air Quality Objective; as set out in the Air Quality Strategy (2007) and the Air Quality Standards Regulations (2010)
NO_2	Nitrogen Dioxide
NO_x	Nitrous Oxides, generally considered to be nitric oxide and NO_2. Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
PM_{10}	Small airborne particles less than 10µm aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5µm aerodynamic diameter
Receptor	A location where the effects of pollution may occur.
UNECE	United Nations Economic Commission for Europe
$\mu g/m^3$	Micrograms (one millionth of a gram) per cubic metre.

APPENDIX 8.1 – VERIFICATION

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides ($NO_x = NO + NO_2$). The model has been run to predict the 2016 annual mean road-NOx contribution at two roadside diffusion tubes (identified in **Table 8.11**).

The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (**Figure 8.1.1**). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (**Figure 8.1.2**).

The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Primary adjustment factor: 1.7523

Secondary adjustment factor: 1.0007

The results imply that overall, the model was under-predicting the road-NOx contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

Figure 8.1.3 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line. The monitoring sites all lie within the ±25% line.

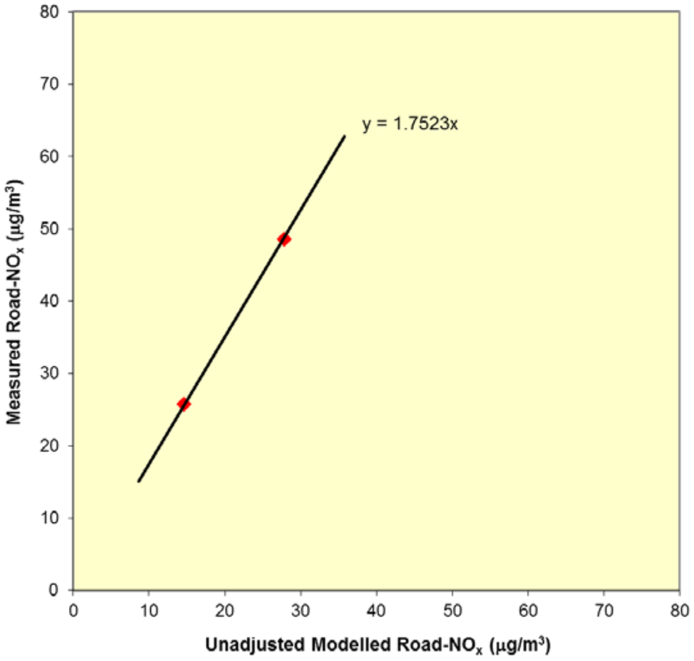


Figure 8.1.1: Comparison of Measured Road-NOx with Unadjusted Modelled Road-NO_x Concentrations

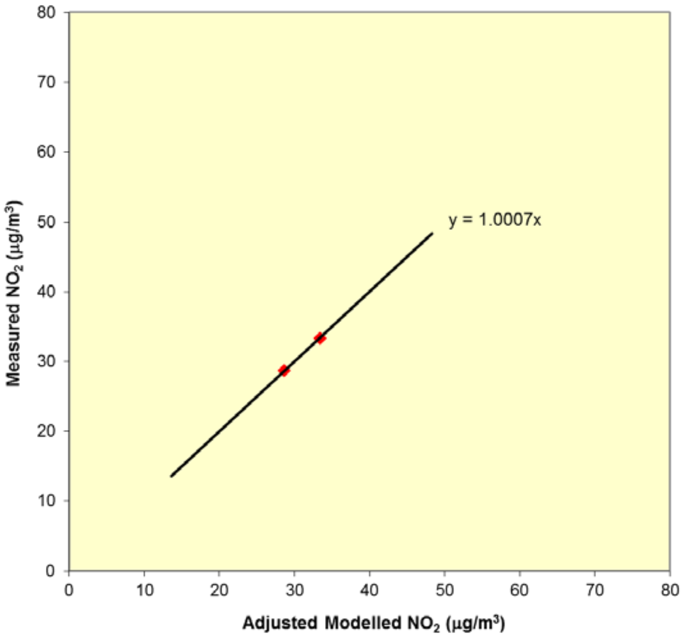


Figure 8.1.2: Comparison of Measured Road-NO_x with Adjusted Modelled Road-NO_x Concentrations

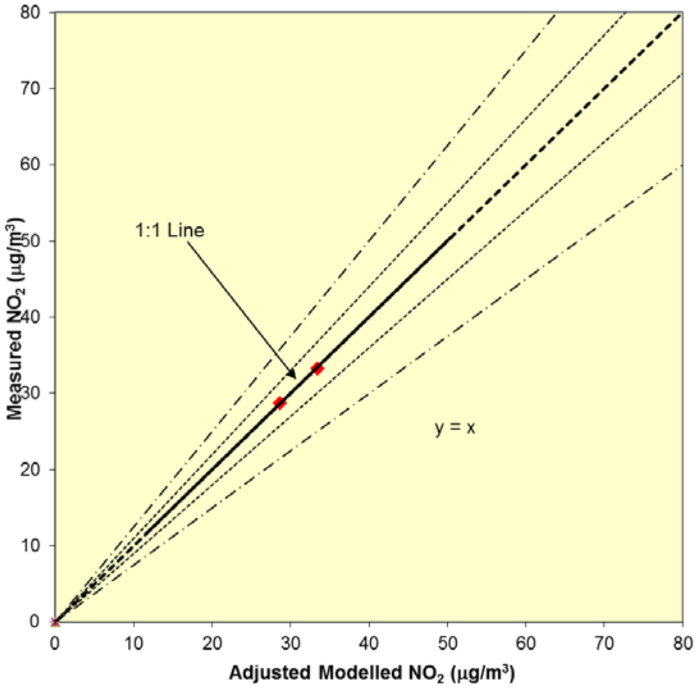


Figure 8.1.3: Comparison of Final Adjusted NO_2 with Measured NO_2 Concentrations

<u>PM_{10} and $PM_{2.5}$</u>

There is no PM_{10} or $PM_{2.5}$ monitoring in close proximity to the proposed Application Site. Therefore, the primary adjustment factor calculated for NO_2 concentrations has been applied to the modelled road-PM_{10} concentrations.

APPENDIX 8.2 – TRAFFIC DATA

Link Number	Location	2016 Baseline		2022 Baseline		2022 With Application		2031 Allocation Test Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
1	A260 Oxford Road	10002	4.67%	10821	4.55	10979	4.50	13716	4.19%
2	B430	4333	2.86%	4676	2.81	4736	2.79	5959	2.64%
3	Station Road	5253	5.59%	6265	5.06	6555	4.88	10222	3.91%
4	A260 Banbury Road	10433	4.41%	10831	4.42	10832	4.42	11999	4.41%
5	Station Road	2728	6.49%	4323	4.71	4895	4.27	10126	2.94%
6	B4030 Lower Heyford Road (west)	4673	3.57%	4850	3.57	4850	3.57	5368	3.56%
7	Water Street	2441	5.35%	2533	5.35	2533	5.35	2891	5.22%
8	Camp Road (west of Kirtlington Road)	2082	8.69%	3226	6.41	3634	5.83	7455	4.02%
9	Kirtlington Road	539	1.35%	656	1.33	696	1.31	1034	1.31%
10	Port Way	2316	1.98%	2501	1.95	2541	1.94	3069	1.88%
12	B4030 Lower Heyford Road (east)	4368	3.24%	4534	3.25	4534	3.25	5021	3.24%
15	Unnamed Road (north of B4030)	3623	3.81%	4963	3.17	5453	2.97	9243	2.45%
16	B4030 (south)	8075	3.09%	9906	2.85	10395	2.76	15143	2.46%
17	Unnamed Road (west of B430)	1942	9.32%	3715	5.88	4338	5.21	10249	3.79%

Link Number	Location	2016 Baseline		2022 Baseline		2022 With Application		2031 Allocation Test Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
18	M40 Junction 10 Northbound Slip A	31371	10.72%	34914	10.08	35552	9.92	46158	8.67%
19	M40 Junction 10 Northbound Slip B	26310	12.60%	28119	12.38	28398	12.26	33590	11.70%
20	B430 Ardley Road North	11809	5.64%	15195	7.54	16032	7.21	25968	3.62%
21	B430 Ardley Road South	8760	5.55%	9959	5.07	9959	5.07	12230	4.56%
22	B4030 Bicester Road	7392	5.34%	10154	4.60	10360	4.53	15783	3.88%
23	B430 Oxford Road	9570	4.04%	10735	3.81	11019	3.74	13954	3.40%
24	B4030 South of Lower Heyford Road	7898	3.59%	9400	3.29	9890	3.17	14134	2.74%
27	Camp Road (east of Kirtlington Road)	2415	7.65%	3577	5.89	4013	5.38	7988	3.93%
29	Unnamed Road (East of A4260 Banbury Road)	561	1.26%	1223	1.21	1489	1.16	3232	1.21%
37	A4260 (north of Somerton / North Ashton Roads)	10659	4.47%	11502	4.37	11661	4.32	14471	4.04%
38	North Ashton Road	1507	1.26%	1564	1.26	1564	1.26	1730	1.26%
39	Somerton Road	1418	3.01%	1472	3.02	1472	3.02	1629	3.01%

Link Number	Location	2016 Baseline		2022 Baseline		2022 With Application		2031 Allocation Test Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
47	B430 Northampton Road	7762	4.00%	9096	3.63	9379	3.54	12465	3.11%
60	A43 east of B4110	45584	11.05%	49186	10.67	49578	10.59	60014	9.80%
67	Middleton Stoney Road	7145	2.70%	10311	2.00	10488	1.98	16405	1.52%
70	Camp Road (east of gate 7)	3411	9.22%	4876	7.24	5492	6.57	8745	4.52%
71	Development Access 2	0	0.00%	0	0.00	472	1.24	897	1.24%
72	Camp Road (west of Development Access 2a)	3673	9.56%	5119	7.70	5915	6.83	9440	4.80%
73	Development Access 2a	0	0.00%	0	0.00	0	0.00	281	1.24%
74	Camp Road (east of Development Access 2a)	3672	9.57%	5117	7.71	5912	6.84	9551	4.77%
75	Development Access 3 South	188	0.63%	346	0.91	818	1.10	818	1.10%
76	Camp Road (East of Development Access 3 South)	3742	9.40%	5247	7.53	6223	6.55	9865	4.65%
77	Access 3a	0	0.00%	0	0.00	0	0.00	281	1.24%
78	Camp Road (East of Development Access 3a)	3739	9.40%	5246	7.53	6222	6.54	9975	4.61%

Link Number	Location	2016 Baseline		2022 Baseline		2022 With Application		2031 Allocation Test Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
86	Development Access 7	1113	0.63%	1963	0.89	1963	0.89	1963	0.89%
87	Development Access 8	575	4.10%	1157	2.66	1157	2.66	5219	0.89%
88	Camp Road (East of Development Access 8)	4458	8.22%	6716	6.25	7692	5.61	12139	4.06%
90	Camp Road (East of Development Access 9)	4537	8.05%	6916	6.08	7892	5.48	12380	3.99%
91	Development Access 10	970	0.00%	6716	6.25	702	0.38	2498	0.29%
92	Camp Road (East of Development Access 10)	4777	7.21%	6916	6.08	8323	4.96	12859	3.68%
93	Development Access 11	307	0.00%	445	0.39	445	0.39	445	0.39%
96	Camp Road (East of Development Access 11a)	4983	7.33%	7610	5.56	8585	5.07	13128	3.79%
97	Development Access 11b	63	0.63%	63	0.63	63	0.63	211	1.06%
98	Camp Road (East of Development Access 11b)	5006	7.31%	7651	5.53	8626	5.05	13276	3.76%
99	Development Access 12 North	264	0.63%	349	0.78	349	0.78	349	0.78%

Link Number	Location	2016 Baseline		2022 Baseline		2022 With Application		2031 Allocation Test Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
100	Camp Road (East of Development Access 12 North and South)	5127	7.14%	7806	5.44	8782	4.97	13435	3.72%
101	Development Access 12 South	63	0.63%	63	0.63	63	0.63	63	0.63%
102	Development Access 13 North	92	0.63%	154	0.88	154	0.88	607	1.15%
103	Camp Road (East of Development Access 13 North and South)	5250	6.97%	7959	5.33	8935	4.89	13835	3.63%
104	Development Access 13 South	226	0.63%	226	0.63	226	0.63	374	0.87%
106	Camp Road (East of Development Access 14)	5264	6.94%	7978	5.31	8953	4.87	13867	3.62%
108	Camp Road (East of Development Access 15)	4504	5.95%	6964	4.62	7940	4.21	13134	3.12%
109	Chilgrove Drive	0	0.00%	0	0.00	0	0.00	10665	4.88%
110	Unnamed Road South of Chilgrove Drive	3623	3.81%	4963	3.17	5453	2.97	9243	2.45%

APPENDIX 8.3 – FUTURE YEAR EMISSIONS CALCULATIONS

Introduction

Atmospheric dispersion modelling is used to determine the effect of future development traffic on local air quality. The modelling utilises predictions of the composition and emissions profile of the vehicle fleet which are produced by Defra in the emissions factor toolkit (EFT). The composition and emissions profiles are provided on a year by year basis from 2013 to 2030, with the database being periodically updated.

The main issue with regard to the modelling of future traffic impacts is the choice of emission factors to use given that there is a degree of uncertainty as to the accuracy of the emission factors, as well as uncertainty introduced by the modelling process and the traffic data on which the predictions are based. This has become more important in recent years as it has been realised that previous versions of the EFT were likely to have significantly underestimated the real world emissions of the vehicle fleet, as well as the more recent revelations concerning the use of 'defeat devices' on VW group vehicles.

This note therefore sets out PBAs approach to the choice of vehicle emission factors for future year assessments. The note has been revised following updating of the Defra Emissions Factor Toolkit in November 2017.

Modelling Methodology

As a prelude to the discussion of emission factors, it is useful to recap on the general methodology that is used for dispersion modelling of road traffic emissions:

- Traffic data is entered into the dispersion model to represent the baseline situation and the model is used to predict how NO_x emissions are dispersed in the environment.
- The dispersion modelling predictions are compared to monitoring data to obtain a verification factor; the factor by which the predicted road traffic concentration must be multiplied by to agree with the monitored concentration.
- The modelling is repeated for the future year situation; with traffic data representing the situation without the development in place (the 'without' scheme scenario) and with the development in place ('with' scheme). In both cases, the verification factor obtained from the baseline modelling is used to multiply the model results by, in essence assuming that the model is equally as accurate in the future as it was for the baseline scenario.

The verification factor is one of the key elements in the discussion regarding vehicle emission factors. One element of uncertainty in the modelling is the degree to which the emission factors in the EFT are different to actual emissions of the vehicle fleet on the local road network. The use of the verification factor for the future year predictions essentially assumes that the difference between the EFT emission factors and real world emissions is the same in the future as it was in the baseline year. In other words, unless there is some reason to believe that the future year emission factors are less accurate than the baseline year emission factors, the degree to which the EFT emission factors and real world emission factors differ is taken into account in the modelling by the use of the verification factor. This is discussed further in the following sections.

Emission Factor Toolkit

The EFT contains estimates of the future composition of the vehicle fleet in terms of the age and type of vehicles. The composition of the vehicle fleet is primarily related to the age of the vehicles (in terms of their emissions class) and the fuel that they use (i.e. petrol or diesel). In general terms, the majority of new vehicles replace much older vehicles, and as the emissions performance of vehicles is generally taken to improve over time, both current and historical versions of the EFT predict very large reductions in NO_x emissions in the future. It is also obvious that the further one looks into the future, the more uncertain the predictions become as they depend on the rate of vehicle renewal and the size and fuel mix of the vehicles bought; which are all estimates.

The emissions performance of the vehicles is classified in terms of Euro type approval testing; Euro 1 to 6 concerning light duty vehicles and Euro I to VI heavy duty vehicles. Whilst the introduction of each Euro class has generally seen a tightening of emission standards, the standards up until now have been based on laboratory testing of vehicles. The emissions performance of the vehicles in real world driving conditions has been higher than the laboratory testing results, especially for diesel vehicles. This factor was not recognised in earlier versions of the EFT, and combined with the fact that diesel vehicles have much higher NO_x emissions than petrol vehicles and there has been a very large increase in the number of diesel vehicles on the road, has meant that the NO_x emissions and NO_2 concentrations have not reduced as previously predicted.

The trends in NO_x emissions in the vehicle fleet, especially diesel vehicles and the accuracy of the current version of the EFT, is therefore critical in terms of the choice of emission factors in modelling.

Trends in NO_x emissions

For light duty vehicles, the latest Euro standard is Euro 6, which was introduced from September 2015 (with a derogation in the UK for the registration of new vehicles until September 2016).

The emissions standards currently relate to a laboratory test whereby the average emission rate is calculated over an idealised drive cycle. The cycle used is the New European Drive Cycle (NEDC) and there has been extensive criticism that the drive cycle does not represent real world driving conditions. It has therefore been agreed that a new drive cycle will be introduced, the World Light-duty Test Cycle (WLDTC), as well as an on-road test termed Real Driving Emissions (RDE).

Up until September 2017, Euro 6 vehicles were only tested in the laboratory against the NEDC, and these vehicles are termed Euro 6ab. However, from September 2017, new models are tested against the WLDTC and will also have a RDE test. The initial introduction of the RDE test will allow vehicles to have average RDE test emissions of 2.1 times the WLDTC test standard. The 2.1 factor is termed the conformity factor and will apply to new vehicle models from September 2017 and all new vehicles from September 2019. From January 2020, the conformity factor will reduce to 1.5 for new vehicle models (January 2021 for all new vehicles).

Air Quality Consultants undertook some research into the performance of diesel vehicles to support a methodology that they have adopted for undertaking air quality assessments[23]. As part of the analysis, they compared the real word test results of current Euro 6ab diesel vehicles and calculated an average conformity factor of 3.9 from the tests that were assessed. This work led to AQC publishing the CURED v2A calculator which attempted to take account of the real-world emissions performance of diesel vehicles. The approach using CURED v2A was generally accepted to be conservative when considering developments a long time in the future.

[23] Emissions of Nitrogen Oxides from Modern Diesel Vehicles. AQC January 2016

Subsequently, the Department for Transport have undertaken testing of Euro 5 and 6ab diesel vehicles and found that the average NO_x emissions were 1135 mg/km for Euro 5 vehicles and 500 mg/km for Euro 6ab vehicles[24]. These work out to be a conformity factor of 6.30 and 6.25 for Euro 5 and Euro 6ab respectively. Adding in the DfTr results to the AQC results gives an overall average conformity factor for Euro 6ab vehicles tested of 4.1.

A paper presented by Dr Marc Stettler at the recent Westminster Energy, Environment & Transport Forum[25] included results of RDE testing of existing Euro 6ab vehicles. Whilst there was wide range in the results, a number of the vehicles tested did already comply with the Euro 6c standard.

Similar results have been reported in a study led by Rosalind O'Driscoll of Imperial College[26]. This showed that the average NO_x emissions were 4.5 times higher than the Euro 6 limit, with an average NO_2 percentage of 44%.

From the emissions testing work undertaken to date on Euro 6ab vehicles it is clear that the NO_x emissions performance of Euro 6ab vehicles is significantly better than Euro 5 vehicles, although not in line with the laboratory standards. The introduction of Euro 6 should therefore see a significant reduction in NO_x emissions in the future, as outlined in the following table.

Emission Standard	Real Driving Emissions NO_x mg/km
Euro 5, DfTr testing	1135
Euro 6ab, DfTr testing	500
Euro 6c, September 2017 models	168
Euro 6c, January 2020 models	120

Further testing of vehicles is ongoing, with Emissions Analytics regularly publishing the results of real world emissions testing on vehicles[27]. Also, in the November 2017 budget, the government announced a one-off tax on new diesel cars not meeting Euro 6c standards. Both of these factors should help put pressure on vehicle manufacturers to meet the RDE standards. In the longer term, there is also the move to electric vehicles which will gather pace.

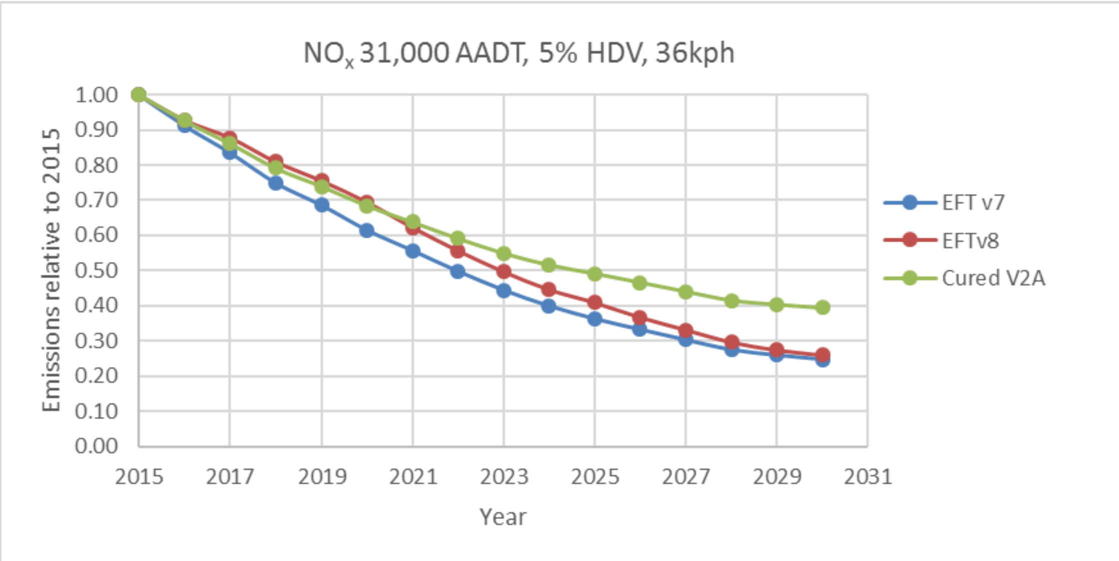
Emissions in the EFT

As noted in Section 3, the EFT contains estimates of vehicle emissions by Euro Class. The database was updated in November 2017 from v7.0 to v8.0. It now uses NO_x emissions factors for the vehicles taken from the European Environment Agency's COPERT 5 database, compared to the previous COPERT 4 version v11. In the November 2015 submissions to the European Union for compliance against EU Limit Values, Defra used

[24] Vehicle Emissions Testing Programme DfTr Cm 9259 April 2016
[25] Priorities for reducing air quality impacts of road vehicles. Dr Marc Stettler 17th May 2016
[26] A Portable Emissions Measurement System (PEMS) study of NO_x and primary NO_2 emissions from Euro 6 diesel passenger cars and comparison with COPERT emission factors. Rosalind O'Driscoll. September 2016
[27] http://equaindex.com/equa-air-quality-index/

COPERT 4 v11 factors without taking account of the real-world performance of the vehicle fleet to data.

The EFT now takes account of the real-world performance of Euro 6ab diesel cars, applying a high conformity factor to these vehicles. For Euro 6c vehicles, it assumes that the RDE will be effective in bringing down vehicle emissions. The following graph shows the relative decline in vehicle NO_x emissions predicted for a road in outer London with 5% Heavy Duty Vehicle traffic travelling at 36kph. As air quality models are verified against historic data, the emissions decline is shown relative to 2015.



For emission years prior to 2021, the CURED v2A methodology is likely to give similar results to using the EFT v8.0 data. Post 2021, when the introduction of Euro 6c begins to take effect, then CURED v2A and the EFT v8.0 begin to diverge.

Future Year Assessment Methodology

The selection of emission factors for a future year assessment depends partly on the situation regarding the assessment to be undertaken. Where pollutant concentrations are low and are unlikely to exceed threshold levels, then one may take a conservative approach and keep emission factors at current levels. This will produce a conservative result, but as the result will be ‘acceptable’ in terms of leading to no exceedances of National Air Quality Strategy Objectives, then it is a reasonable approach to adopt as it avoids uncertainty as to whether there will be exceedances in the future.

In contrast, where pollutant concentrations are high, then a different approach to uncertainty is required. In addition, for a formal Environmental Impact Assessment the legal requirement is to assess ‘likely significant effects’. This is not ‘worst case’ significant effects, but ‘likely’ significant effects and therefore must allow for a degree of uncertainty in the predictions.

As discussed in Section 2, the use of the verification factor in the modelling takes account, amongst other things, of the difference in the real-world emissions performance of vehicles in the fleet. For developments up until 2021, the current EFT should be reasonably accurate as to NO_x emissions as the problem with the performance of diesel vehicles has been recognised. As such, one is justified in using the emission factors for the year of the assessment as the uncertainty in the emission factors is taken account of by using the verification factor.

Developments post 2021 will increasingly be influenced by the assumption that the RDE testing of diesel vehicles is effective, which may or may not turn out to be the case. In essence, the result is likely to lie between the green and red curves of the previous graph. This is likely to become less important as the actual levels of emissions is significantly reduced in the future. If a conservative approach is warranted, one could follow the green curve, the effect of which is outlined in the table below.

Assessment Year	Emission Factor Year
2015	2015
2016	2016
2017	2017
2018	2018
2019	2019
2020	2020
2021	2021
2022	**2021**
2023	2022
2024	2022
2025	2023
2026	2023
2027	2024
2028	2024

Assessment Year	Emission Factor Year
2029	2025
2030	2025
Beyond 2030	2025

In the case of a large development with a completion year a long time into the future, then if only completion year traffic data is available, it is likely to be appropriate to assume that the completed year traffic data occurs at the opening year of the development. As appropriate, change in emission year in accordance with the above table may be considered.

APPENDIX 8.4 – FIGURES